

Optimizing Aperture Photometry for PreCam: FWHM Cuts

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DES Calibrations Telecon

26 August 2011



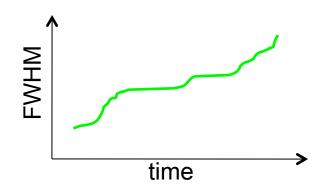
Why FWHM Cuts?

DARK ENERGY SURVEY

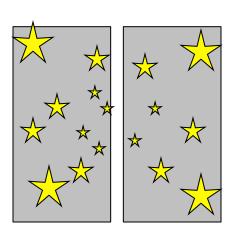
 The fraction of light measured in a fixed aperture depends on the PSF size of the star.



2. For calibrations during the night, variations in seeing/focus can add difficulties in comparing photometry for exposures taken at different times during the night.

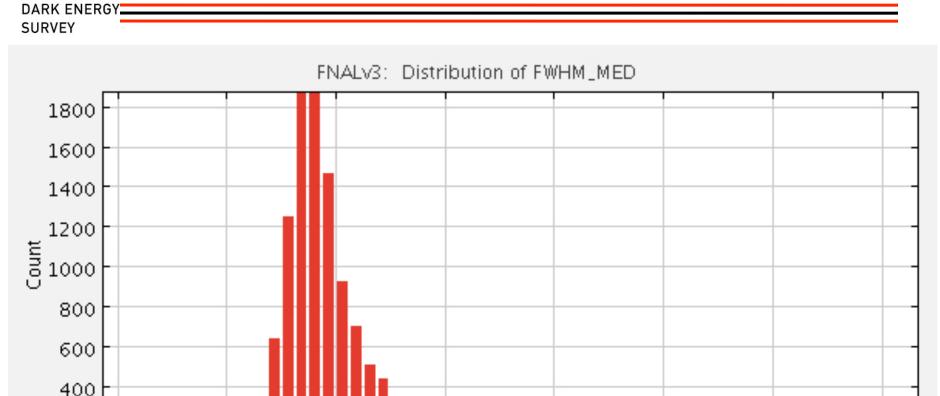


3. For PreCam, the PSF varies substantially across the focal plane, adding difficulties in comparing photometry of objects at different locations within the same image... or of the same objects in overlapping exposures.





Where to Cut?: Distribution of FWHM_MED? Problems



(Histogram includes all FNALv3 ccmap-wcs-*.v3.cat files.)

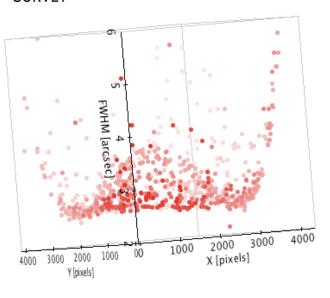
FWHM_MED [arcsec]

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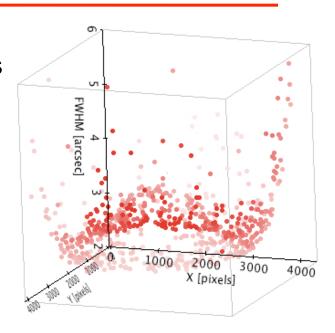


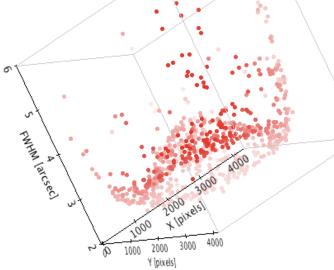
3D Distribution of FWHM vs. X,Y: The Mexican Hat





A Good Image At Different Orientations



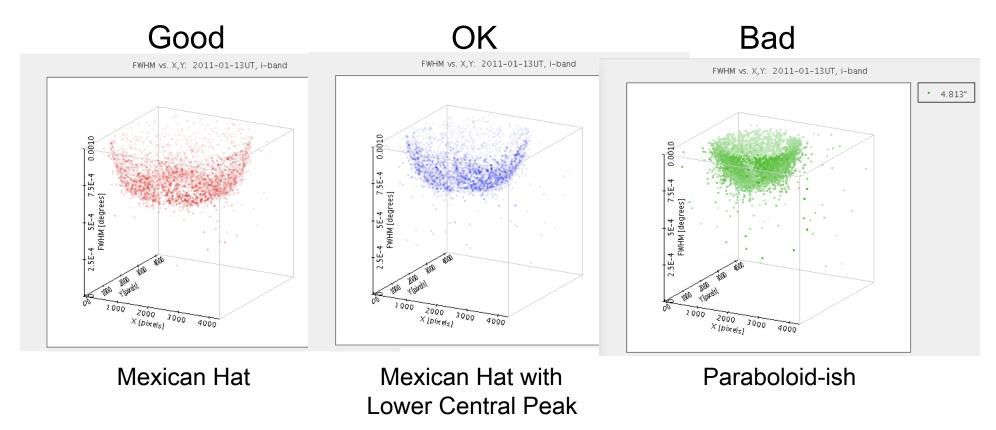


Additional confirmation of ANL results (H. Spinka, S. Kuhlmann, K. Kuehn, & T. Bailey)

3D Distribution of FWHM vs. X,Y for Images with Good, OK, and Poor Focus

DARK ENERGY SURVEY

Individually

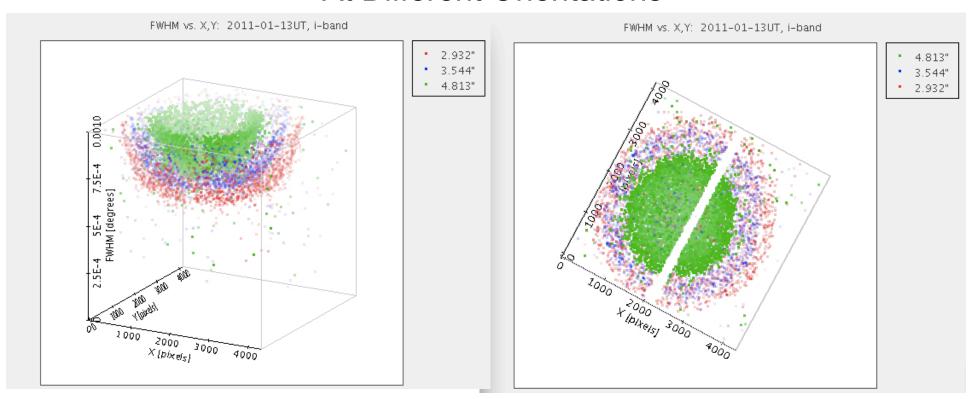


(Object images with FWHM>3.6 arcsec have been cut.)

3D Distribution of FWHM vs. X,Y for Images with Good, OK, and Poor Focus

SURVEY

All Together, At Different Orientations





DARK ENERGY	
SURVEY	

==========		========	========							
P9	6F				PERCENTAGE	OF FLUX WITH	HIN APERTURE	DIAMETER		
FWHM (")	FWHMpix (pix)	1	24.00" 16.55pix	14.86" 10.25pix	12.00" 8.28pix		8.00" 5.52pix			2.00" 1.38pix
2.0	1.4	1	100,0000	100,0000	100,0000	100,0000	99,9985	99,8038	93.7379	49,9759
2.5	1.7		100,0000	100,0000	100,0000	99,9985	99,9169	98,1496	83.0215	35,8089
3.0	2.1	į	100,0000	100,0000	99,9985	99,9545	99,2742	93,7379	70,8118	26,4975
3.5	2.4	:	100,0000	99,9996	99,9709	99,6498	97,3186	86,9396	59,5339	20,2423
4.0	2.8		100,0000	99,9929	99,8038	98,6821	93,7379	78,9548	49,9759	15,9002
4.5	3,1	1	100,0000	99.9476	99,2742	96.7306	88.7990	70.8118	42,1485	12.7875
5.0	3,4		100,0000	99.7797	98,1496	93.7379	83.0215	63.1177	35,8089	10.4906
5.5	3.8	1	99,9998	99,3631	96,3018	89,8713	76,9031	56.1471	30,6753	8.7523
6.0	4.1		99,9985	98,5718	93,7379	85,3988	70,8118	49.9759	26,4975	7.4076
6.5	4.5	į	99,9921	97,3223	90,5655	80,5912	64,9798	44.5783	23,0728	6.3474
7.0	4.8	į	99,9709	95,5909	86,9396	75,6735	59,5339	39,8842	20,2423	5.4975
7.5	5.2		99,9169	93,4071	83,0215	70,8118	54,5292	35,8089	17,8830	4.8063
8.0	5₊5	1	99,8038	90,8362	78,9548	66.1181	49,9759	32,2689	15,9002	4,2368
8.5	5₊9		99,6003	87,9609	74,8556	61.6611	45,8586	29,1875	14,2207	3,7622
9.0	6.2	1	99,2742	84.8674	70,8118	57.4777	42.1485	26.4975	12.7875	3,3627
9.5	6.6		98,7975	81.6361	66,8853	53.5826	38.8107	24.1414	11.5559	3,0233
10.0	6.9	į	98,1496	78,3365	63,1177	49,9759	35,8089	22,0700	10,4906	2,7326
10.5	7.2		97,3186	75,0261	59,5339	46,6485	33,1080	20,2423	9,5636	2,4818
11.0	7.6	į	96,3018	71.7502	56,1471	43,5859	30,6753	18,6234	8.7523	2,2638
11.5	7.9		95,1044	68.5431	52,9616	40,7707	28,4807	17,1842	8.0385	2,0732
12.0	8.3	i	93,7379	65,4299	49,9759	38,1846	26,4975	15,9002	7,4076	1,9057



DARK ENERGY

SURVI	ENERGY EY		7 7 7			~ ~ ~				
PSF PERCENTAGE OF FLUX WITHIN APERTURE DIAMETER										
FWHM	FWHMpix		24.00"	14.86"	12.00"	10.00"	8.00"	6.00"	4.00"	2.00"
(")	(pix)		16.55pix	10.25pix	8.28pix	6.90pix	5.52pix	4.14pix	2.76pix	1.38pix
2.0	1.4	1	100,0000	100,0000	100,0000	100,0000	99,9985	99,8038	93,7379	49,9759
2.5	1.7		100,0000	100,0000	100,0000	99,9985	99,9169	98,1496	83,0215	35,8089
3.0	2.1		100,0000	100,0000	99,9985	99,9545	99,2742	93,7379	70,8118	26,4975
3.5	2.4		100,0000	99,9996	99,9709	99,6498	97,3186	86,9396	59,5339	20,2423
4.0	2.8		100,0000	99,9929	99,8038	98,6821	93,7379	78,9548	49,9759	15,9002
4.5 5.0 5.0 6.5 7.5 8.5 9.5 10.0	3.1 3.4 3.8 4.1 4.5 4.8 5.9 6.6 6.9		100,0000 100,0000 99,9998 99,9985 99,9709 99,9169 99,8038 99,6003 99,2742 98,7975 98,1496	99,9476 99,7797 99,3631 98,5718 97,3223 95,5909 93,4071 90,8362 87,9609 84,8674 81,6361 78,3365	99,2742 98,1496 96,3018 93,7379 90,5655 86,9396 83,0215 78,9548 74,8556 70,8118 66,8853 63,1177	96,7306 93,7379 89,8713 85,3988 80,5912 75,6735 70,8118 66,1181 61,6611 57,4777 53,5826 49,9759	88.7990 83.0215 76.9031 70.8118 64.9798 59.5339 54.5292 49.9759 45.8586 42.1485 38.8107 35.8089	70.8118 63.1177 56.1471 49.9759 44.5783 39.8842 35.8089 32.2689 29.1875 26.4975 24.1414 22.0700	42.1485 35.8089 30.6753 26.4975 23.0728 20.2423 17.8830 15.9002 14.2207 12.7875 11.5559 10.4906	12,7875 10,4906 8,7523 7,4076 6,3474 5,4975 4,8063 4,2368 3,7622 3,3627 3,0233 2,7326
10.5	7.2		97,3186	75,0261	59,5339	46,6485	33,1080	20,2423	9,5636	2,4818
11.0	7.6		96,3018	71,7502	56,1471	43,5859	30,6753	18,6234	8,7523	2,2638
11.5	7.9		95,1044	68,5431	52,9616	40,7707	28,4807	17,1842	8,0385	2,0732
12.0	8.3		93,7379	65,4299	49,9759	38,1846	26,4975	15,9002	7,4076	1,9057



DARK ENERGY

SURV	ENERGY_		7 7 7								
PS	:====== 6F		PERCENTAGE OF FLUX WITHIN APERTURE DIAMETER								
FWHM (")	FWHMpix (pix)	 	24.00" 16.55pix	14.86" 10.25pix	12.00" 8.28pix	10.00" 6.90pix	8.00" 5.52pix	6.00" 4.14pix	4.00" 2.76pix	2.00" 1.38pix	
2.0 2.5 3.0 3.5 4.0	1.4 1.7 2.1 2.4 2.8 3.1		100,0000 100,0000 100,0000 100,0000 100,0000	100,0000 100,0000 100,0000 99,9996 99,9929 99,9476	100,0000 100,0000 99,9985 99,9709 99,8038 99,2742	100,0000 99,9985 99,9545 99,6498 98,6821 96,7306	99,9985 99,9169 99,2742 97,3186 93,7379 88,7990	99,8038 98,1496 93,7379 86,9396 78,9548 70,8118	93,7379 83,0215 70,8118 59,5339 49,9759 42,1485	49,9759 35,8089 26,4975 20,2423 15,9002 12,7875	
5.0 5.5 6.0 6.5 7.0 7.5 8.0	3.4 3.8 4.1 4.5 4.8 5.2 5.5		100,0000 99,9998 99,9985 99,9921 99,9709 99,9169 99,8038	99,7797 99,3631 98,5718 97,3223 95,5909 93,4071 90,8362	98,1496 96,3018 93,7379 90,5655 86,9396 83,0215 78,9548	93,7379 89,8713 85,3988 80,5912 75,6735 70,8118 66,1181	83,0215 76,9031 70,8118 64,9798 59,5339 54,5292 49,9759	63,1177 56,1471 49,9759 44,5783 39,8842 35,8089 32,2689	35,8089 30,6753 26,4975 23,0728 20,2423 17,8830 15,9002	10,4906 8,7523 7,4076 6,3474 5,4975 4,8063 4,2368	
8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0	5.9 6.2 6.6 6.9 7.2 7.6 7.9 8.3		99,6003 99,2742 98,7975 98,1496 97,3186 96,3018 95,1044 93,7379	87,9609 84,8674 81,6361 78,3365 75,0261 71,7502 68,5431 65,4299	74,8556 70,8118 66,8853 63,1177 59,5339 56,1471 52,9616 49,9759	61,6611 57,4777 53,5826 49,9759 46,6485 43,5859 40,7707 38,1846	45,8586 42,1485 38,8107 35,8089 33,1080 30,6753 28,4807 26,4975	29.1875 26.4975 24.1414 22.0700 20.2423 18.6234 17.1842 15.9002	14.2207 12.7875 11.5559 10.4906 9.5636 8.7523 8.0385 7.4076	3,7622 3,3627 3,0233 2,7326 2,4818 2,2638 2,0732 1,9057	

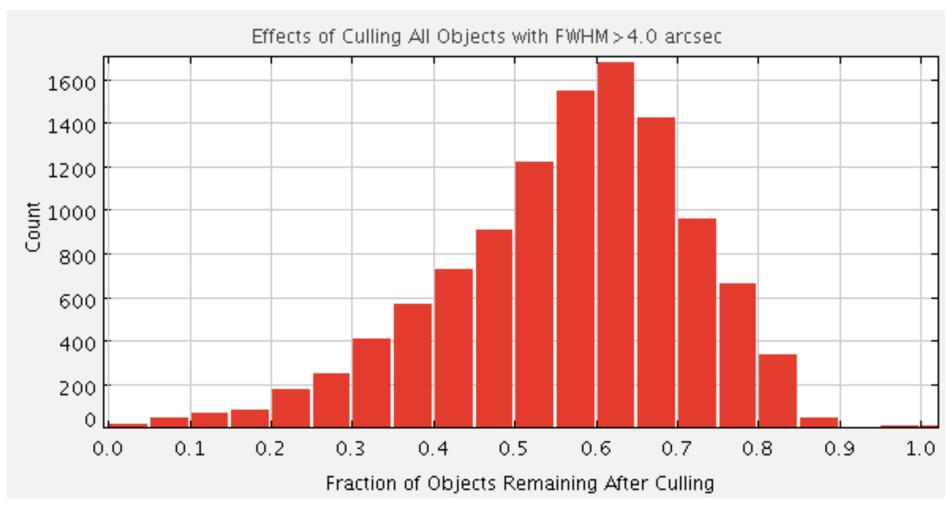


DARK ENERGY

SURVEY		7 07 07							7 0 7 0 7
PSF	=			PERCENTAGE	OF FLUX WIT	THIN APERTURE	DIAMETER		
FWHM FWHMpi (") (pix)		24.00" 16.55pix	14.86" 10.25pix	12.00" 8.28pix	10.00" 6.90pix	8.00" 5.52pix	6.00" 4.14pix	4.00" 2.76pix	2.00" 1.38pix
2.0 1.4 2.5 1.7 3.0 2.1 3.5 2.4 4.0 2.8 4.5 3.1 5.0 3.4 5.5 3.8 6.0 4.1 6.5 4.5 7.0 4.8 7.5 5.2 8.0 5.5 8.5 5.9 9.0 6.2 9.5 6.6 10.0 6.9 10.5 7.2 11.0 7.6 11.5 7.9 12.0 8.3	mo	ore sky	100,0000 100,0000 100,0000 99,9996 99,9929 99,9476 99,7797 99,3631 98,5718 97,3223 apertur backgr 5ier res 75,0261 71,7502 68,5431 65,4299	ound	100,0000 99,9985 99,9545 99,6498 98,6821 96,7306 93,7379 89,8713 85,3988 80,5912 75,6735 70,8118 66,1181 61,6611 57,4777 53,5826 49,9759 46,6485 43,5859 40,7707 38,1846	99,9985 99,9169 99,2742 97,3186 93,7379 88,7990 83,0215 76,9031 70,8118 64,9798 59,5339 54,5292 49,9759 45,8586 42,1485 38,8107 35,8089 33,1080 30,6753 28,4807 26,4975	99,8038 98,1496 93,7379 86,9396 78,9548 70,8118 63,1177 56,1471 49,9759 44,5783 39,8842 35,8089 32,2689 29,1875 26,4975 24,1414 22,0700 20,2423 18,6234 17,1842 15,9002	93,7379 83,0215 70,8118 59,5339 49,9759 42,1485 35,8089 30,6753 26,4975 23,0728 20,2423 17,8830 15,9002 14,2207 12,7875 11,5559 10,4906 9,5636 8,7523 8,0385 7,4076	49,9759 35,8089 26,4975 20,2423 15,9002 12,7875 10,4906 8,7523 7,4076 6,3474 5,4975 4,8063 4,2368 3,7622 3,3627 3,0233 2,7326 2,4818 2,2638 2,0732 1,9057

Effects of Culling All Objects @ FWHM>4": Fraction of Objects Remaining

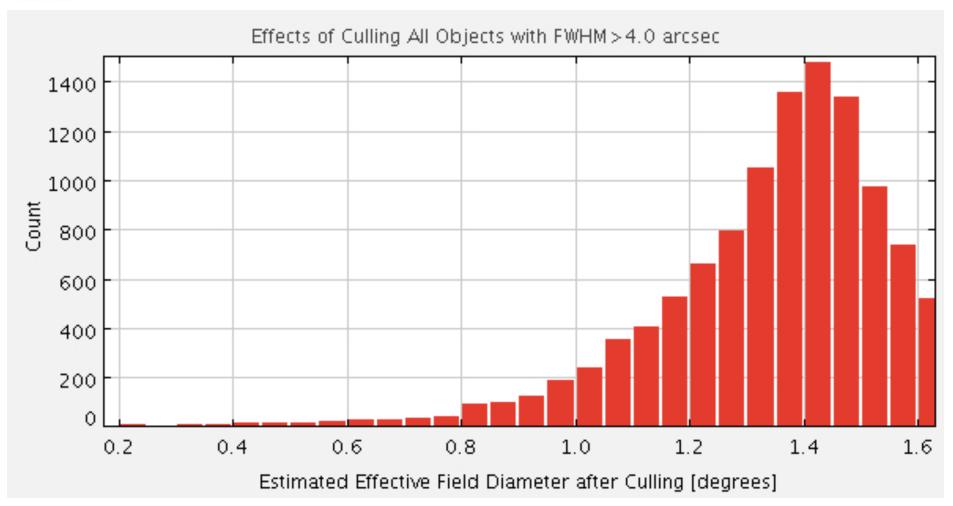




(Histogram includes all FNALv3 ccmap-wcs-*.v3.cat files.)

Effects of Culling All Objects @ FWHM>4": Estimated Effective Field Diameter





(Histogram includes all FNALv3 ccmap-wcs-*.v3.cat files.)



SURVEY

Conclusion

- Culling objects with FWHM > 4.0 arcsec and using an aperture of diameter 10.0 arcsec (6.90 pixels) seems a reasonable choice (but maybe not the only choice).
- For the ccmap-wcs-*.v3.cat files, mag_aper_10 corresponds to an aperture diameter of 10.0 arcsec (6.90 pixels).



Extra Slides

DARK ENERGY______SURVEY